

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in CIVIL ENGINEERING
COURSE STRUCTURE & SYLLABUS (R18)

Applicable From 2018-19 Admitted Batch

I YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA101BS	Mathematics - I	3	1	0	4
2	PH102BS	Engineering Physics	3	1	0	4
3	CS103ES	Programming for Problem Solving	3	1	0	4
4	ME104ES	Engineering Graphics	1	0	4	3
5	PH105BS	Engineering Physics Lab	0	0	3	1.5
6	CS106ES	Programming for Problem Solving Lab	0	0	3	1.5
7	*MC109ES	Environmental Science	3	0	0	0
		Induction Programme				
		Total Credits	13	3	10	18

I YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA201BS	Mathematics - II	3	1	0	4
2	CH202BS	Chemistry	3	1	0	4
3	ME203ES	Engineering Mechanics	3	1	0	4
4	ME205ES	Engineering Workshop	1	0	3	2.5
5	EN205HS	English	2	0	0	2
6	CH206BS	Engineering Chemistry Lab	0	0	3	1.5
7	EN207HS	English Language and Communication Skills Lab	0	0	2	1
		Total Credits	12	3	8	19.0

II YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	CE301PC	Surveying and Geomatics	3	0	0	3
2	CE302PC	Engineering Geology	2	0	0	2
3	CE303PC	Strength of Materials - I	3	1	0	4
4	MA304BS	Probability and Statistics	3	1	0	4
5	CE305PC	Fluid Mechanics	3	1	0	4
6	CE306PC	Surveying Lab	0	0	3	1.5
7	CE307PC	Strength of Materials Lab	0	0	3	1.5
8	CE308PC	Engineering Geology Lab	0	0	2	1
9	*MC309	Constitution of India	3	0	0	0
		Total Credits	17	3	8	21

II YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EE401ES	Basic Electrical and Electronics Engineering	3	0	0	3

2	CE402ES	Basic Mechanical Engineering for Civil Engineers	2	0	0	2
3	CE403PC	Building Materials, Construction and Planning	3	0	0	3
4	CE404PC	Strength of Materials - II	3	0	0	3
5	CE405PC	Hydraulics and Hydraulic Machinery	3	0	0	3
6	CE406PC	Structural Analysis - I	3	0	0	3
7	CE407PC	Computer aided Civil Engineering Drawing	0	0	3	1.5
8	CE409PC	Hydraulics and Hydraulic Machinery Lab	0	0	3	1.5
9	EE409ES	Basic Electrical and Electronics Engineering Lab	0	0	2	1
10	*MC409	Gender Sensitization Lab	0	0	2	0
		Total Credits	17	0	10	21

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
4	CE501	Structural Analysis-II	3	0	0	3
2	CE502PC	Geotechnical Engineering	3	0	0	3
3	CE503PC	Structural Engineering –I (RCC)	3	1	0	4
4	CE504PC	Transportation Engineering	3	0	0	3
5		Professional Elective-I	3	0	0	3
6	SM505MS	Engineering Economics and Accountancy	2	0	0	2
7	CE506PC	Highway Engineering and Concrete Technology Lab	0	0	3	1.5
8	CE507PC	Geotechnical Engineering Lab	0	0	3	1.5
9	EN508HS	Advanced Communication Skills Lab	0	0	2	1
10	*MC509	Intellectual Property Rights	3	0	0	0
		Total Credits	20	1	8	22

III YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	CE601PC	Hydrology & Water Resources Engineering	3	1	0	4
1	CE602PC	Environmental Engineering	3	0	0	3
2	CE603PC	Foundation Engineering	3	0	0	3
3	CE604PC	Structural Engineering –II (Steel)	3	1	0	4
5		Professional Elective –II	3	0	0	3
6		Open Elective –I	3	0	0	3
7	CE605PC	Environmental Engineering Lab	0	0	2	1
8	CE606PC	Computer Aided Design Lab	0	0	2	1
9	*MC609	Environmental Science	3	0	0	0
		Total Credits	21	2	4	22

IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	CE701PC	Estimation, Costing and Project Management	3	1	0	4
2		Professional Elective –III	3	0	0	3
3		Professional Elective –IV	3	0	0	3
4		Open Elective –II	3	0	0	3
5	SM702MS	Professional Practice law & Ethics	2	0	0	2

6	CE703PC	Industrial Oriented Mini Project/ Summer Internship	0	0	0	2*
7	CE704PC	Seminar	0	0	2	1
8	CE705PC	Project Stage - I	0	0	6	3
		Total Credits	14	1	12	21

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective -V	3	0	0	3
2		Professional Elective –VI	3	0	0	3
3		Open Elective –III	3	0	0	3
4	CE801PC	Project Stage-II	0	0	14	7
		Total Credits	9	0	14	16

***MC - Environmental Science – Should be Registered by Lateral Entry Students Only.**

***MC – Satisfactory/Unsatisfactory**

Note: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

Professional Elective – I

CE511PE	Concrete Technology
CE512PE	Theory of Elasticity
CE513PE	Rock Mechanics

Professional Elective – II

CE611PE	Prestressed Concrete
CE612PE	Elements of Earth Quake Engineering
CE613PE	Advanced Structural Analysis

Professional Elective-III

CE711PE	Remote Sensing &GIS
CE712PE	Ground Improvement Techniques
CE713PE	Advanced Structural Design

Professional Elective -IV

CE721PE	Irrigation and Hydraulic Structures
CE722PE	Pipeline Engineering
CE723PE	Ground Water Hydrology

Professional Elective –V

CE811PE	Solid Waste Management
CE812PE	Environmental Impact Assessment
CE813PE	Air pollution

Professional Elective -VI

CE821PE	Airports, Railways and Waterways
CE822PE	Urban Transportation Planning
CE823PE	Finite Element Methods for Civil Engineering

CE701PC: ESTIMATION, COSTING AND PROJECT MANAGEMENT**B.Tech. IV Year I Sem.**

L	T/P/D	C
3	1/0/0	4

Course Objectives: The subject provide process of estimations required for various work in construction. To have knowledge of using SOR & SSR for analysis of rates on various works and basics of planning tools for a construction projects.

Course Outcomes: On completion of the course, the students will be able to:

- understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
- quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
- understand how competitive bidding works and how to submit a competitive bid proposal.
- An idea of how to optimize construction projects based on costs
- An idea how construction projects are administered with respect to contract structures and issues.
- An ability to put forward ideas and understandings to others with effective communication processes

UNIT – I

General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating. Detailed Estimates of Buildings

UNIT – II

Reinforcement bar bending and bar requirement schedules Earthwork for roads and canals.

UNIT – III

Rate Analysis – Working out data for various items of work over head and contingent charges.

UNIT- IV

Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation -Standard specifications for different items of building construction.

UNIT- V

Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts.

Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion

NOTE: NUMBER OF EXERCISES PROPOSED:

1. Three in flat Roof & one in Sloped Roof
2. Exercises on Data – three Nos.

TEXT BOOKS:

1. Estimating and Costing by B.N. Dutta, UBS publishers, 2000.

2. Estimating and Costing by G.S. Birdie
3. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016
4. Chitkara, K. K. Construction Project Management. Tata McGraw-Hill Education, 2014

REFERENCE BOOKS:

1. Standard Schedule of rates and standard data book by public works department.
2. S. 1200 (Parts I to XXV – 1974/ method of measurement of building and Civil Engineering works – B.I.S.)
3. Estimation, Costing and Specifications by M. Chakraborti; Laxmi publications.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015

CE711PE: REMOTE SENSING & GIS (PE – III)**B.Tech. IV Year I Sem.****L T/P/D C**
3 0/0/0 3**Course Objectives:**

- Know the concepts of Remote Sensing, its interpreting Techniques and concepts of Digital images
- know the concept of Geographical Information System (GIS), coordinate system GIS Data and its types
- Understand the students managing the spatial Data Using GIS.
- Understand Implementation of GIS interface for practical usage.

Course Outcomes: After the completion of the course student should be able to

- **Describe** different concepts and terms used in Remote Sensing and its data
- Understand the Data conversion and Process in different coordinate systems of GIS interface
- **Evaluate** the accuracy of Data and implementing a GIS
- **Understand the applicability of** RS and GIS for various applications.

UNIT - I:

Concepts of Remote Sensing Basics of remote sensing- elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology & units, energy resources, energy interactions with earth surface features & atmosphere, atmospheric effects, satellite orbits, Sensor Resolution, types of sensors. Remote Sensing Platforms and Sensors, IRS satellites.

Remote Sensing Data Interpretation Visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of soil, water and vegetation. Concepts of Digital image processing, image enhancements, qualitative & quantitative analysis and pattern recognition, classification techniques and accuracy estimation.

UNIT - II:

Introduction to GIS: Introduction, History of GIS, GIS Components, GIS Applications in Real life, The Nature of geographic data, Maps, Types of maps, Map scale, Types of scale, Map and Globe, Co-ordinate systems, Map projections, Map transformation, Geo-referencing,

UNIT - III:

Spatial Database Management System: Introduction: Spatial DBMS, Data storage, Database structure models, database management system, entity-relationship model, normalization
Data models and data structures: Introduction, GIS Data model, vector data structure, raster data structure, attribute data, geo-database and metadata,

UNIT - IV:

Spatial Data input and Editing: Data input methods – keyboard entry, digitization, scanning, conversion of existing data, remotely sensed data, errors in data input, Data accuracy, Micro and Macro components of accuracy, sources of error in GIS. **Spatial Analysis:** Introduction, topology, spatial analysis, vector data analysis, Network analysis, raster data analysis, Spatial data interpolation techniques

UNIT - V: Implementing a GIS and Applications

Implementing a GIS: Awareness, developing system requirements, evaluation of alternative systems, decision making using GIS

Applications of GIS: GIS based road network planning, Mineral mapping using GIS, Shortest path detection using GIS, Hazard Zonation using remote sensing and GIS, GIS for solving multi criteria problems, GIS for business applications.

TEXT BOOKS:

1. Remote Sensing and GIS by Basudeb Bhatta, Oxford University Press, 2nd Edition, 2011.
2. Introduction to Geographic Information systems by Kang-tsung Chang, McGraw Hill Education (Indian Edition), 7th Edition, 2015.
3. Fundamentals of Geographic Information systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.

REFERENCE BOOKS:

1. Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, Wiley Publishers, 7th Edition, 2015.\
2. Geographic Information systems – An Introduction by Tor Bernhardsen, Wiley India Publication, 3rd Edition, 2010.
3. Advanced Surveying: Total Station, GIS and Remote Sensing by Satheesh Gopi, R. SathiKumar, N. Madhu, Pearson Education, 1st Edition, 2007.
4. Textbook of Remote Sensing and Geographical Information systems by M. Anji Reddy.

CE712PE: GROUND IMPROVEMENT TECHNIQUES (PE – III)**B.Tech. IV Year I Sem.****L T/P/D C**
3 0/0/0 3**Prerequisites:** Geo-Technical Engineering, Foundation Engineering**Course Objectives:**

- To know the need of ground improvement
- To acquire the knowledge on the various ground improvement techniques available and their applications for different types of soils
- To understand suitable ground improvement technique for given soil conditions.

Course Outcomes: at the end of the course the student able to

- Know the necessity of ground improvement
- Understand the various ground improvement techniques available
- Select & design suitable ground improvement technique for existing soil conditions in the field

UNIT - I:

Introduction to Engineering Ground Modification: Need and objectives, Identification of soil types, In situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, and their applications.

UNIT - II:

Mechanical Modification: Shallow Compaction Techniques- Deep Compaction Techniques- Blasting-Vibrocompaction- Dynamic Tamping and Compaction piles.

UNIT - III:

Hydraulic Modification: Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Electro-kinetic dewatering-Filtration, Drainage and Seepage control with Geosynthetics, Preloading and vertical drains,

UNIT - IV:

Physical and Chemical Modification – Modification by admixtures, Modification Grouting, Introduction to Thermal Modification including freezing.

UNIT - V:

Modification by Inclusions and Confinement - Soil reinforcement, reinforcement with strip, and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing.

TEXT BOOKS:

1. Hausmann, M. R. (1990) – Engineering Principles of Ground Modifications, McGraw Hill publications
2. M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis

REFERENCE BOOKS:

1. Koerner, R. M (1994) – Designing with Geosynthetics – Prentice Hall, New Jersey
2. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
3. Xianthakos, Abreimson and Bruce - Ground Control and Improvement, John Wiley & Sons, 1994.
4. K. Krisch & F. Krisch (2010) - Ground Improvement by Deep Vibratory Methods, Spon Press, Taylor and Francis
5. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

CE713PE: ADVANCED STRUCTURAL DESIGN (PE – III)**B.Tech. IV Year I Sem.**

L	T/P/D	C
3	0/0/0	3

Prerequisites: Structural Engineering I(RCC) & II(STEEL) and Structural analysis**Course Objective:** To make the student more conversant with the design principles of critical structures using limit state approach**Course Outcomes:** At the end of the course the student will able to:

- Enhance the capabilities to design the special structural elements as per Indian standard code of practice.
- Analyze, design, draw and detailing of critical structural components with a level of accuracy

UNIT – I

Design and Detailing of cantilever type of Retaining walls – Stability Check. Principles & Design of Counter fort Retaining walls.

UNIT – II**Flat slabs:** Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears**Ribbed slabs:** Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.**UNIT – III****Design of RCC Circular Water Tanks.****UNIT – IV**

Introduction - Definition and basic forms – Components of a bridge - Classification of bridges – IRC Loading Standards and specifications - Design of Reinforced Concrete Slab Bridge decks

UNIT – V**Design of Steel Gantry Girders.****TEXT BOOKS:**

1. Advanced RCC by Krishnam Raju, CBS Publishers & distributors, New Delhi.
2. Advanced RCC by Varghese, PHI Publications, New Delhi.
3. Structural Design and drawing (RCC and steel) by Krishnam Raju, Univ. Press, New Delhi
4. R.C.C Structures by Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications, New Delhi

REFERENCE BOOKS:

1. RCC Designs by Sushil Kumar, standard publishing house.
2. Fundamentals of RCC by N.C. Sinha and S.K. Roy, S. Chand Publications, New Delhi.
3. N. Krishna Raju, Design of Bridges, Oxford & IBH Publishing Company Pvt. Ltd, New Delhi. Fourth edition 2009.

CE721PE: IRRIGATION AND HYDRAULIC STRUCTURES (PE – IV)**B.Tech. IV Year I Sem.****L T/P/D C**
3 0/0/0 3**Pre-Requisites:** Hydraulics, Hydrology & Water Resources Engineering**Course Objectives:** To study various types of storage works and, diversion headwork, their components and design principles for their construction.**Course Outcomes:** At the end of the course, the student will be able to:

- Know types of water retaining structures for multiple purposes and its key parameters considered for planning and designing
- Understand details in any Irrigation System and its requirements
- Know, Analyze and Design of a irrigation system components

UNIT - I

Storage Works-Reservoirs - Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve- Reservoir Sedimentation – Life of Reservoir. Types of dams, factors affecting selection of type of dam, factors governing selection of site for a dam.

UNIT - II

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile, and practical profile of a gravity dam, limiting height of a low gravity dam, Factors of Safety - Stability Analysis, Foundation for a Gravity Dam, drainage and inspection galleries.

UNIT- III

Earth dams: types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage. Spillways: types of spillways, Design principles of Ogee spillways - Spillway gates. Energy Dissipaters and Stilling Basins Significance of Jump Height Curve and Tail Water Rating Curve - USBR and Indian types of Stilling Basins.

UNIT- IV

Diversion Head works: Types of Diversion head works- weirs and barrages, layout of diversion head work - components. Causes and failure of Weirs and Barrages on permeable foundations, -Silt Ejectors and Silt Excluders

Weirs on Permeable Foundations – Creep Theories - Bligh's, Lane's and Khosla's theories, Determination of uplift pressure- Various Correction Factors – Design principles of weirs on permeable foundations using Creep theories - exit gradient, U/s and D/s Sheet Piles - Launching Apron.

UNIT- V

Canal Falls - types of falls and their location, Design principles of Notch Fall and Sarada type Fall. Canal regulation works, principles of design of cross and distributary head regulators, types of Canal escapes - types of canal modules, proportionality, sensitivity, setting and flexibility. Cross Drainage works: types, selection of suitable type, various types, design considerations for cross drainage works

TEXT BOOKS:

1. Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg, Khanna Publishers.
2. Irrigation engineering by K. R. Arora Standard Publishers.
3. Irrigation and water power engineering by Punmia & Lal, Laxmi publications Pvt. Ltd., New Delhi

REFERENCE BOOKS:

1. Theory and Design of Hydraulic structures by Varshney, Gupta & Gupta
2. Irrigation Engineering by R.K. Sharma and T.K. Sharma, S. Chand Publishers 2015.
3. Irrigation Theory and Practice by A. M. Micheal Vikas Publishing House 2015.
4. Irrigation and water resources engineering by G.L. Asawa, New Age International Publishers.

CE722PE: PIPELINE ENGINEERING (PE – IV)**B.Tech. IV Year I Sem.****L T/P/D C**
3 0/0/0 3**Pre-Requisites:** Fluid Mechanics, Hydraulics and Hydraulic machinery**Course Objectives:**

- To familiarize the students with the various elements and stages involved in transportation of water.
- To understand standards and practices in piping design.
- To know various equipment and their operation in pipeline transportation.
- To understand technology in transportation of fluids.

Course Outcome: At the end of the course the student will be able to:

- Get an understanding of the key steps in a pipeline's lifecycle: design, construction, installation, asset management and maintenance.

UNIT - I

Elements of pipeline design: Types of piping systems; transmission lines, In-plant piping systems, Distribution mains, Service lines. Types of Water distribution networks; serial networks, branched networks and looped networks. Network components and Network model. Basic hydraulic principles; continuity and Energy principle.

Pipeline route selection, survey and geotechnical guidelines: Introduction - Preliminary route selection - Key factors for route selection - Engineering survey - Legal survey - Construction / As-built survey - Geotechnical design.

UNIT – II

Frictional Head loss in Pipes: Major and Minor losses, Artificially roughened pipes, moody Diagram. Friction coefficient relationships, Empirical formulae, Simple pipe flow problems Equivalent pipes; pipes in series, parallel, series-parallel; problems. Water Hammer and energy transmission through pipes: gradual and Instantaneous closure

UNIT– III

Reservoirs, Pumps and Valves: Types of Reservoirs, Pumps; introduction, system head-discharge-pump head and head-discharge relationships, characteristic curves, pump combination. Valves: check valves, flow control valves, Pressure Reducing valves, both Flow control and Pressure Reducing Valves.

Network Parameters and Types of analysis: Network parameters, Parameter interrelationships, Necessity of Analysis, common Assumptions, types of analysis, rules for Solvability of Pipe networks.

UNIT – IV

Network Formulation of Equations: States of parameters, Single-Source Networks with known pipe Resistances. Multisource Networks with known pipes resistances. Networks with unknown pipe resistances. Inclusion of Pumps, Check Valves, Flow Control Valves and Pressure Reducing Valves – Problems.

Hardy Cross Method: Methods of balancing heads (Loop Method). Method of Balancing Flows (Node Method). Modified Hardy Cross Method. Convergence Problem. Different software for WDN analysis and design.

UNIT - V

Materials selection and quality management: Elements of design – Materials designation standards – Quality management.

Pipeline construction: Construction – Commissioning.

Pipeline protection, Instrumentation, pigging & Operations: Pipeline coating – Cathodic protection – Cathodic protection calculations for land pipelines – Internal corrosion – Flow meters and their calibration – Sensors – Pigs-Pipeline Operations and maintenance.

TEXT BOOKS:

1. Analysis of Water Distribution Networks, P.R. Bhave and R. Gupta, Narosa Publishing House Pvt. Ltd.
2. Pipeline Engineering, Henry Liu, Lewis Publishers (CRC Press), 2003.
3. Piping and Pipeline Engineering: Design, Construction, Maintenance Integrity and Repair, George A. Antaki, CRC Press, 2003.

REFERENCE BOOKS:

1. Piping Calculation Manual, E. Shashi Menon, McGraw-Hill, 2004.
2. Pipeline Rules of Thumb Handbook, E. W. McAllister, 7th Edition, 2009.
3. Liquid Pipeline Hydraulics, E. Shashi Menon, Mareel Dekker Inc., 2004.

CE723PE: GROUND WATER HYDROLOGY (PE – IV)**B.Tech. IV Year I Sem.****L T/P/D C**
3 0/0/0 3**Pre-Requisites:** Hydraulics & Fluid Mechanics**Course objectives: The objectives of the course are:**

- **To explain** the concepts of Groundwater Development and Management.
- To **demonstrate and** derive the basic equations used in Groundwater development and management and the corresponding equations
- To know the investigations, field studies to conduct basic ground water studies.

Course Outcomes: On successful completion of this course, students should be able to:

- **Identify** different fundamental equations and concepts as applied in the Groundwater studies
- **Discuss** and derive differential equation governing groundwater flow in three dimensions
- To **solve** groundwater mathematical equations and analyze pumping tests in steady and non-steady flow cases
- **Distinguish** and understand the saline water intrusion problem in coastal aquifers

UNIT- I**Ground Water Occurrence**

Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, Vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as aquifers, types of aquifers, porosity, specific yield and specific retention. Ground Water Movement-Permeability, Darcy's law, storage coefficient, Transmissivity, Differential equation governing ground water flow in three dimensions derivation, ground water flow equation in polar coordinate system, ground water flow contours and their applications.

UNIT- II**Analysis of Pumping Test Data-I**

Steady flow ground water flow towards a well in confined and unconfined aquifers-Dupit's and Theism's equations, assumptions, formation constants, yield of an open well interface and well tests.

UNIT- III**Analysis of Pumping Test Data-II**

Unsteady flow towards well-Non-Equilibrium equations, Theis solution, Jacob and Chow's simplifications, Leak aquifers.

UNIT- IV**Surface and sub-surface Investigation**

surface methods of exploration-Electrical resistivity method and Seismic refraction methods. Subsurface methods geophysical logging and resistivity logging. Concept of artificial recharge of ground water, recharge methods, Applications of GIS and RS in artificial recharge of ground water along with case studies.

UNIT- V**Saline water intrusion in aquifer**

Occurrence of saline water intrusion, Ghyben-Herzberg relation, Shape of interface, control of water intrusion. Ground water basin management-case studies.

TEXT BOOKS

1. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.

2. Ground water by H.M. Raghunath, Wiley Eastern Ltd.
3. Groundwater System Planning & Management, R. Willes & W.W.G. Yeh, Prentice Hall.

REFERENCE BOOKS:

1. Ground water by Bawwvr, John Wiley & Sons.
2. Applied Hydrogeology by C.W. Fetta, CBS Publishers & Distributors.
3. Ground Water Assessment, Development and Management by K R Karanth, McGraw Hill Publications.

CE811PE: SOLID WASTE MANAGEMENT (PE – V)**B.Tech. IV Year II Sem.**

L	T/P/D	C
3	0/0/0	3

Course Objectives: The objectives of the course are to

- **Define** the terms **and Understands** the necessity of solid waste management
- **Explain** the strategies for the collection of solid waste
- **Describe** the solid waste disposal methods
- **Categorize** Hazardous Waste

Course Outcomes: At the end of the course the student will able to:

- Identify the physical and chemical composition of solid wastes
- Analyze the functional elements for solid waste management.
- Understand the techniques and methods used in transformation, conservation, and recovery of materials from solid wastes.
- Identify and design waste disposal systems

UNIT- I

Solid Waste: Definitions, Types of solid wastes, sources of solid wastes, Characteristics, and perspectives; properties of solid wastes, Sampling of Solid wastes, Elements of solid waste management - Integrated solid waste management, Solid Waste Management Rules 2016.

UNIT - II

Engineering Systems for Solid Waste Management: Solid waste generation; on-site handling, storage and processing; collection of solid wastes; Stationary container system and Hauled container systems – Route planning - transfer and transport; processing techniques;

UNIT- III

Engineering Systems for Resource and Energy Recovery: Processing techniques; materials recovery systems; recovery of biological conversion products – Composting, pre and post processing, types of composting, Critical parameters, Problems with composting - recovery of thermal conversion products; Pyrolysis, Gasification, RDF - recovery of energy from conversion products; materials and energy recovery systems.

UNIT- IV

Landfills: Evolution of landfills – Types and Construction of landfills – Design considerations – Life of landfills- Landfill Problems – Lining of landfills – Types of liners – Leachate pollution and control – Monitoring landfills – Landfills reclamation.

UNIT- V

Hazardous waste Management: – Sources and characteristics, Effects on environment, Risk assessment – Disposal of hazardous wastes – Secured landfills, incineration - Monitoring – Biomedical waste disposal, E-waste management, Nuclear Wastes, Industrial waste Management

TEXT BOOKS:

1. Tchobanoglous G, Theisen H and Vigil SA 'Integrated Solid Waste Management, Engineering Principles and Management Issues' McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, 'Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.

REFERENCE BOOKS:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, 'Environmental Engineering', McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, 'Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

CE812PE: ENVIRONMENTAL IMPACT ASSESSMENT (PE – V)**B.Tech. IV Year II Sem.****L T/P/D C**
3 0/0/0 3**Course Objectives:** The objectives of the course are to

- **Define and Classify** Environmental Impacts and the terminology
- **Understands** the environmental Impact assessment procedure
- **Explain** the EIA methodology
- **List and describe** environmental audits

Course Outcomes: At the end of the course the student will be able to

- Identify the environmental attributes to be considered for the EIA study
- Formulate objectives of the EIA studies
- Identify the methodology to prepare rapid EIA
- Prepare EIA reports and environmental management plans

UNIT- I

Introduction: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

UNIT- II

EIA Methodologies: Environmental attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts.

UNIT- III

Environmental Management Plan: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.

UNIT- IV

Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules.

Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria-case studies.

UNIT- V

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

TEXT BOOKS:

1. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

REFERENCE BOOKS:

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.

CE813PE: AIR POLLUTION (PE – V)**B.Tech. IV Year II Sem.****L T/P/D C**
3 0/0/0 3**Course Objectives:** The objectives of the course are to

- **Understand the** Air pollution Concepts
- **Identify** the source of air pollution
- **Know** Air pollution Control devices
- **Distinguish the** Air quality monitoring devices

Course Outcomes: At the end of the course the student will be able to

- Identify sampling and analysis techniques for air quality assessment
- Describe the plume behavior for atmospheric stability conditions
- Apply plume dispersion modelling and assess the concentrations
- Design air pollution controlling devices

UNIT- I

Air Pollution: Definition of Air Pollution - Sources & Classification of Air Pollutants - Effects of air pollution - Global effects – Ambient Air Quality and standards – Monitoring air pollution, Sampling and analysis of Pollutants in ambient air - Stack sampling.

UNIT- II

Meteorology and Air Pollution: Factors influencing air pollution, Wind rose, Mixing Depths, Lapse rates and dispersion - Atmospheric stability, Plume behaviour, Plume rise and dispersion, Prediction of air quality, Box model - Gaussian model - Dispersion coefficient - Application of tall chimney for Pollutant dispersion.

UNIT- III

Control of Particulate Pollutants: Properties of particulate pollution - Particle size distribution - Control mechanism - Dust removal equipment – Working principles and operation of settling chambers, cyclones, wet dust scrubbers, fabric filters & ESP.

UNIT- IV

Control of Gaseous Pollutants: Process and equipment for the removal by chemical methods - Working principles and operation of absorption and adsorption equipment - Combustion and condensation equipment.

UNIT- V

Automobile and Indoor Pollution: Vehicular pollution – Sources and types of emission – Effect of operating conditions-Alternate fuels and emissions-Emission controls and standards, Strategies to control automobile pollution– Causes of indoor air pollution-changes in indoor air quality-control and air cleaning systems-indoor air quality.

TEXT BOOKS:

1. M.N. Rao and HVN Rao, Air Pollution, Tata McGraw Hill Publishers
2. Noel, D. N., Air Pollution Control Engineering, Tata McGraw Hill Publishers, 1999.

REFERENCE BOOKS:

1. Air Pollution Control Engineering by Nevers, , McGraw-Hill, Inc., 2000.
2. Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H.
3. Air Pollution and Health by T. Holgate, Hillel S. Koren, Jonathan M. Samet, Robert L. Maynard publisher Academic Press.

CE821PE: AIRPORT, RAILWAYS, AND WATERWAYS (PE – VI)**B.Tech. IV Year II Sem.**

L	T/P/D	C
3	0/0/0	3

Course Objectives: the objectives of the course are to

- Deal with the characteristics of aircrafts related to airport design; runway and taxiway design, runway orientation, length, grading and drainage.
- Introduce component of railway tracks, train resistance, crossing, signaling, high speed tracks and Metro Rail.
- Explain the classes of harbors, features, planning and design of port facilities.

Course Outcomes: At the end of this course, the students will develop:

- An ability to design of runways and taxiways.
- An ability to design the infrastructure for large and small airports
- An ability to design various crossings and signals in Railway Projects.
- An ability plan the harbors and ports projects including the infrastructure required for new ports and harbors.

UNIT – I

Airport Engineering: Introduction to Air Transportation - Aircraft Characteristics - Factors Affecting Selection of site for Airport – Aprons – Taxiway – Hanger – Geometric design - Computation of Runway Length, Correction for Runway Length, Orientation of Runway, Wind Rose Diagram

UNIT - II

Introduction to Railways: Role of Indian Railways in national development – Railways for Urban Transportation – LRT , Mono Rail, Metro Rail & MRTS. Permanent Way: Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks Sleepers – Functions, Materials, Density – Functions, Materials, Ballast, Subgrade and Embankments, Ballast less Tracks.

UNIT – III

Geometric Design of Railway Track: Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal/Vertical Curves.

UNIT – IV

Track maintenance and Operation: Points and Crossings - Turnouts, Stations and Yards - Level Crossings. Signaling and Interlocking - Track Circuiting - Track Maintenance.

UNIT – V

Dock & Harbour Engineering: Water Transportation: Ports and Harbours - Types of water transportation, water transportation in India, Ports and harbours: requirements, classification. Harbour works: breakwaters, jetties, fenders, piers, wharves, dolphins, etc., Navigational aids: types, requirements, light house, beacon lights, buoys, Port facilities: general layout, development, planning, facilities, terminals. Docks and repair facilities: design, dry docks, wet docks, slipways, Locks and lock gates: materials, size, Dredging: classification, dredgers, uses of dredged materials.

TEXT BOOKS:

1. Venkataramaiah C(2016), "Transportation Engineering Vol II – Railways, Airports, Docks, Harbors, Bridges and Tunnels", Universities Press (India) Private Limited, Hyderabad
2. J S Mundrey, Railway Track Engineering (5th Edition) McGraw Hill Education 2017

REFERENCE BOOKS:

1. Subhash C. Saxena (2008) Airport Engineering, Planning and Design, CBS Publishers and Distributors, New Delhi. (Reprint 2015)
2. R. Srinivasan (2016), Harbour, Dock and Tunnel Engineering 28th Edition, Charotar Publishing House Pvt. Ltd.
3. Saxena SC and Arora S C (2010) A Text Book of Railway Engineering Paperback – 2010, Dhanpat Rai Publications (Reprint 2015)
4. Robert Horonjeff, Francis X. McKelvey, Willian J Sproule, Seth B. Young (2010), Planning & Design of Airports, McGraw-Hill Professional.
5. Transportaion Engineering by R. Srinivasa Kumar, University Press India

CE822PE: URBAN TRANSPORTATION PLANNING (PE – VI)**B.Tech. IV Year I Sem.****L T/P/D C**
3 0/0/0 3**Pre-requisites:** Transportation Engineering**UNIT I:****Transport Planning Process:** Scope – interdependence of land use and traffic – systems approach to transport planning – Transport surveys – definition of study area – zoning survey - types and methods – inventory on transport facilities - inventory of land use and economic activities.**UNIT II:****Trip Generation:** Factors governing trip generation and attraction rates – multiple linear regression analysis – category analysis – critical appraisal of techniques.**UNIT III:****Trip Distribution Methods:** Presentation of trip distribution data - PA matrix to OD matrix – Growth factor methods - gravity model and its calibration – opportunity model**UNIT IV:****Modal split analysis:** Influencing factors – Earlier modal split models: Trip end type and trip interchange type – limitations – Disaggregate mode choice model – Logit model - binary choice situations – multinomial logit model – model calibration**UNIT V:****Route assignment:** Description of highway network – route choice behaviour – shortest path algorithm - assignment techniques – all nothing assignment – multi path assignment – capacity restrained assignment – diversion curves**TEXT BOOKS:**

1. Kadiyali, LR (1987), Traffic Engineering and Transportation Planning, Khanna Publishers, New Delhi.
2. Hutchinson, B.G. (1974). Principles of Urban Transport Systems Planning. McGraw Hill Book Company, New York.

REFERENCE BOOKS:

1. Papacostas, C. S., and Prevedouros, P.D. (2002). Transportation Engineering and Planning. 3rd Edition, Prentice - Hall of India Pvt Ltd.
2. NPTEL videos on Urban Transportation Planning, Dr. V. Tamizh Arasan, IIT Madras
3. Paul.H. Wright (1995), Transportation Engineering – Planning & Design, John Wiley & Sons, New york.
4. John W Dickey (1995), Metropolitan Transportation Planning, Tata McGraw-Hill publishing company Ltd, New Delhi.

CE823PE: FINITE ELEMENT METHODS FOR CIVIL ENGINEERING (PE – VI)**B.Tech. IV Year I Sem.****L T/P/D C**
3 0/0/0 3**Pre-Requisites:** SA – I & SA – II**Course Objectives:** The subject provides introduction to finite element methods to analyse structural elements**Course Outcomes:** At the end of the course the student will able to Analyse simple structural elements using Finite Element approach**UNIT – I**

Introduction to Finite Element Method – Basic Equations in Elasticity Stress – Strain equation – concept of plane stress – plane strain advantages and disadvantages of FEM. Element shapes – nodes – nodal degree of freedom Displacement function – Natural Coordinates – strain displacement relations.

UNIT – II

Lagrangian – Serendipity elements – Hermite polynomials – regular, Irregular 2 D & 3D – Element – shape functions upto quadratic formulation.

Finite Element Analysis (FEA) of – one dimensional problems – Bar element – Shape functions stiffness matrix – stress – strain relation

UNIT – III

FEA Beam elements – stiffness matrix - shape function– Analysis of continuous beams.

UNIT – IV

FEA Two-dimensional problem – CST – LST element – shape function – stress – strain.

Isoparametric formulation – Concepts of, isoparametric elements for 2D analysis -formulation of CST element.

UNIT-V

Solution Techniques: Numerical Integration, Static condensation, assembly of elements and solution techniques for static loads.

TEXT BOOKS:

1. A first course in Finite Element Method by Daryl L. Logan, 5th Edition, Cengage Learning India Pvt. Ltd.
2. Introduction to finite Elements in Engineering by Tirupathi R. Chandrupatla, and Ashok D. Belegundu, Prentice Hall of India

REFERENCE BOOKS:

1. Finite Element Aanalysis by P. Seshu, PHI Learning Private Limited
2. Concepts and applications of Finite Element Analysis by Robert D. Cook *et al.*, Wiley India Pvt. Ltd.
3. Applied Finite Element Analysis by G. Ramamurty, I.K. International Publishing House Pvt. Ltd.